



Maplewood  MINNESOTA

Greenhouse Gas Baseline Inventory

June 2016

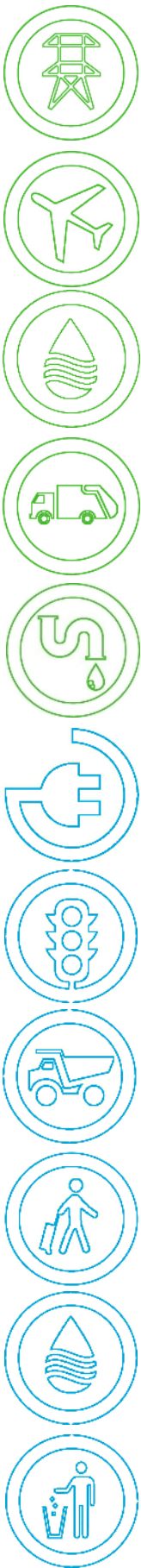


Maplewood GHG Baseline Inventory

Introduction	1
o Background	
o The Carbon Cycle and the Role of Greenhouse Gases	
o Man-Made Greenhouse Contributions	
o Minnesota Climate Change Impacts	
o Why Measure?	
o Methodology, Terminology, and Sources	
o Normalization for Weather	
o Graphic Representations	
Executive Summary	3
o Summary of Inventory Results	
o Community Comparisons	
o Opportunities for Reduction	
o Potential Next Steps for City of Maplewood	
Community Wide Greenhouse Gas Inventory	4
o Community Wide Energy Use	
o Community Wide Travel and Transportation	
o Community Wide Water Use	
o Community Wide Solid Waste	
o Community Wide Waste Water	
o Community Wide Total	
City Operations Greenhouse Gas Inventory	11
o City Operations Buildings and Grounds	
o City Operations Streetlights and Signals	
o City Operations Vehicles	
o City Operations Travel and Transportation	
o City Operations Water and Wastewater Utilities	
o City Operations Solid Waste	
o Total City Operations GHG Inventory	

Report Index

Appendix
o City Operations Buildings and Grounds Detail
o City Operations Streetlights and Signals Detail
o City Operations Vehicles Detail
o City Operations Travel and Transportation Detail
o City Operations Water and Wastewater Detail
o City Operations Solid Waste Detail



Maplewood GHG Baseline Inventory

Background

In January 2016 the City of Maplewood engaged Pale Blue Dot LLC to prepare a Greenhouse Gas (GHG) baseline inventory for City-Wide emissions as well as for City Operations. City-Wide GHG emissions included in this report were to be those already established for the year 2013 through the Regional Indicators Initiative while City Operations baseline data was to be collected and calculated for the first time in this report.

The City of Maplewood is committed to improved sustainability. The City strives to improve upon the natural and built environment by using best practices for sustainability. On June 23, 2008, the City Council adopted the U.S. Mayors Climate Protection Agreement. The agreement commits the City to reducing emissions and pollution in City operations and the community. The Council authorized staff to form a working group to review and make recommendations on how the City can realistically and feasibly reduce emissions and pollution now and in the future. The work group formed is known as the Green Team and is an example of the City's leadership by example.

In December 2010, the City began engagement in the Minnesota Greenstep Cities Program sponsored by the Minnesota Pollution Control Agency. Greenstep Cities is a challenge, assistance, and recognition program supporting cities in achieving sustainability and quality-of-life goals.

This Greenhouse Gas Baseline Inventory report is designed both to meet the requirements for the Greenstep Cities program, but also to provide a framework for on-going dialogue in support of the City's commitment to the US Mayors Climate Protection Agreement

The Carbon Cycle and the Role of Greenhouse Gases

The Carbon Cycle is exchanged among the oceans, atmosphere, and ecosystem. This cycle has been a closed, balanced system for hundreds of thousands of years. This cycle is present in the atmosphere primarily as carbon dioxide and methane. These two primary greenhouse gases uniquely allow light to pass while capturing infrared energy. This "Greenhouse Effect" directly impacts Earth's atmospheric energy and temperatures – without the historic levels of greenhouse gases present in the atmosphere, the average surface temperature of the Earth would be 0 degrees Fahrenheit.

Man-Made Greenhouse Contributions

As our current energy systems are fossil fuel based, nearly all products and services are responsible for GHG emissions. This "Carbon Footprint" results from the emissions of fossil fuels burned either directly, or indirectly in delivering that product or service.

Burning fossil fuels release hydrocarbons which have been outside the natural carbon cycle for millions of years. These emissions have increased atmospheric greenhouse gases by 40%, changing the chemistry and raising the total atmospheric energy and contributing to climate change. According to the EPA, man-made carbon emissions are likely to remain in our atmosphere for hundreds of years. Though unintended, our individual actions and business operations are contributing to climate change impacts. (<https://www3.epa.gov/climatechange/ghgemissions/gases.html>).

Introduction

According to the US EPA:
From "Greenhouse Gas Emissions From Management of Selected Materials in Municipal Solid Waste" 1998

Since the preindustrial era, atmospheric concentrations of CO2 have increased by nearly 30 percent and CH4 concentrations have more than doubled. There is a growing international scientific consensus that this increase has been caused, at least in part, by human activity, primarily the burning of fossil fuels (coal, oil, and natural gas) for such activities as generating electricity and driving cars.

In international scientific circles a consensus is growing that the buildup of CO2 and other GHGs in the atmosphere will lead to major environmental changes such as (1) rising sea levels that may flood coastal and river delta communities; (2) shrinking mountain glaciers and reduced snow cover that may diminish fresh water resources; (3) the spread of infectious diseases and increased heat-related mortality; (4) possible loss in biological diversity and other impacts on ecosystems; and (5) agricultural shifts such as impacts on crop yields and productivity.

Many uncertainties remain regarding the precise timing, magnitude, and regional patterns of climate change and the extent to which mankind and nature can adapt to any changes. It is clear, however, that changes will not be easily reversed for many decades or even centuries because of the long atmospheric lifetimes of GHGs and the inertia of the climate system

Minnesota Climate Change Impacts

Minnesota's climate has already begun to change. Average temperatures in Minnesota are 1.5 to 2 degrees warmer than they were in the 1980's and seven of the State's ten warmest years on record have occurred in the last 15 years. Annual frequency of large storms in Minnesota have more than doubled in the last 50 years, with a 70% increase occurring in just the last decade. Minnesota has seen three "1,000 year" flash floods in only 12 years and scientists anticipate occurrence of extreme weather to continue to increase in frequency.

Climate change has already begun to impact the Minnesota economy. In 2013, the State logged some of the highest severe weather-related claims in the country, and since 1997, 32 severe weather natural disasters cost Minnesota over \$500,000,000. In addition, University of Minnesota economists have calculated the health and environmental costs of our fossil-fuel based electrical production at over \$2,000,000,000 annually.

The State of Minnesota is responding to climate change and is focused on reducing the State's carbon emissions. The State's 2007 Next Generation Energy Act established climate mitigation goals which included a reduction of statewide greenhouse gas emissions to at least 15% below 2005 levels by 2015, 30% below 2005 levels by 2025, and 80% below 2005 levels by 2050. Though the State has missed its first goal, progress has been made and Statewide emissions were reduced between 2007 and 2010 a total of 3%.



Maplewood GHG Baseline Inventory

Why Measure?

As the management consultant and author Peter Drucker noted, "What gets measured gets managed". Measurement provides data both to understand where opportunities for improvement exist as well as to understand and reward success. Measurement of GHG emissions is the essential first step to successfully meet reduction goals. Establishing a baseline emissions understanding and updating the data annually is a critical component of meeting the emission reduction goals established by the City of Maplewood's adoption of the U.S. Mayors Climate Protection Agreement as well as the Statewide reduction targets. By undertaking this initiative to track emissions, the City of Maplewood is yet again illustrating its leadership in sustainability.



I have been struck again and again by how important measurement is to improving the human condition.

Bill Gates

Methodology, Sources, and Terminology

This Greenhouse Gas Baseline Inventory is assembled based on the Greenhouse Gas Protocol for businesses and communities established by GHG Protocol (www.ghgprotocol.org/) and is consistent with the protocol established by ICLEI Local Governments for Sustainability.

The community-wide emissions data referred to in this document are all from City of Maplewood's reporting engagement in the Regional Indicator's Initiative. The City Operations emissions data are based on raw metrics collected by City of Maplewood staff with emissions calculations based on emission factors and Global Warming Potential (GWP) factors established by various sources such as the United States Environmental Protection Agency. All calculations in this document transparently show the emission factors being used as well as source references.

The terminology used in this report is consistent with international Carbon Footprinting protocols. Unless noted otherwise, the Greenhouse Gas (GHG) emissions shown in this report are in CO₂e: Carbon Dioxide Equivalent. CO₂e is a standard for expressing the impact of all greenhouse gas including those from pollutants such as methane and nitrous oxide in terms of the equivalent amount of CO₂ that would have the same impact. GHG emissions are represented in Metric Tonnes (2,204.62 pounds) to be consistent with international standard reporting.

Introduction

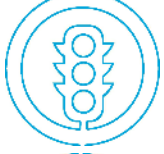
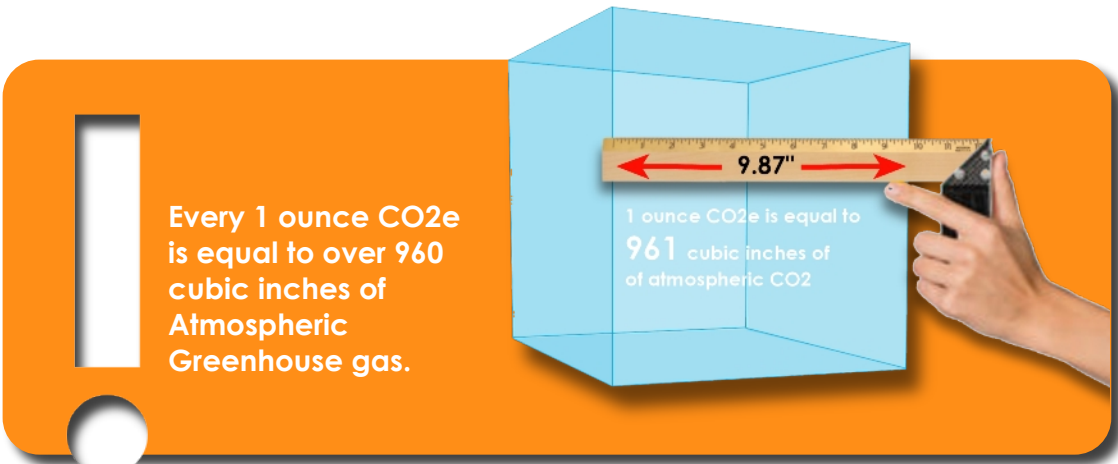
Normalization For Weather

The energy consumption associated with our buildings is very closely related to weather. Colder winters demand more energy consumption to heat our buildings while hotter summers require higher use of air conditioning to maintain temperatures. To facilitate annual comparisons, building energy consumption and GHG emissions should be understood not just in actual levels, but also normalized for weather conditions. This enables a review of year over year GHG performance while filtering out factors which are beyond the City's control.

Weather Normalization is achieved by calculating a normalization factor comparing a given year's total Heating Degree Days (HDD) and Cooling Degree Days (CDD) against a 30 year average. These normalization factors are then applied to the portion of electrical energy typically attributed to cooling and the portion of gas energy typically used for building heat. It is assumed that 25% of all electricity consumption is for air conditioning and for electrical normalization calculations is adjusted by the CDD factor. The remaining 75% of electrical use is unaffected. Similarly, 80% of gas usage in Minnesota is assumed to be for building heating and is adjusted by the HDD factor while the remaining 20% is unaffected in Normalized calculations.

Graphic Representations

Much of the emissions data reported in this Baseline Inventory report are also graphically represented in terms of volume of atmosphere. These representations are a unique hallmark of the Pale Blue Dot's work and they are included in order to help facilitate an increased awareness of the order of magnitude our collective emissions represent. Volumetric calculations used in these graphics are based on the average atmospheric volume occupied by carbon dioxide as calculated by the International Carbon Bank and Exchange.



Maplewood GHG Baseline Inventory

Summary of Inventory Results

This report summarizes the Greenhouse Gas emissions inventory for the City of Maplewood community wide as well as City Operations. Community wide emissions are based on emission data reported to Regional Indicators Initiative. Calculations for the City of Maplewood Operations emissions are based on data collected for this report and can be found in the appendix section.

Community wide emissions total 487,020 Metric Tonnes (1,073,694,032 pounds) CO₂e, 55% of which is produced by residential and commercial energy use. The City operates a total of 8 facilities tracked on B3 Benchmarking, numerous city vehicles, lift/pump stations, street lights, and street signals. Each of these components of the City's operational infrastructure consume grid-based electricity, natural gas, gasoline, or diesel fuel. For the baseline 2015 year, the City of Maplewood municipal operations totaled 5,267.41 Metric Tonnes (11,612,584 pounds) CO₂e.

Forest acres needed to sequester Maplewood Community Wide Greenhouse gas Emissions:
399,197 Acres

Total land within City: 97,420 Acres
Maplewood Tree Cover: 35% (est)

Emissions reduction required for community to sequester its own emissions:
91.5%

Community Comparisons

The results of community GHG inventories vary somewhat due to the information collected, as well as the range of services provided by city entities directly, services contracted out on behalf of the subject city, or services which are provided by entirely separate governmental agencies or privatized. Consequently, a direct city-to-city comparison should not be viewed as a comprehensive comparison of Greenhouse Gas emission efficiencies. We believe, however, that as an emerging practice, municipalities should look towards building and sharing data in order to develop a stronger understanding of where each municipality can advance efficiencies and meet Greenhouse Gas reduction goals. The following is a brief comparison of City Operations Emissions between a few Twin City Metro communities:

City Operations	Metric Tonnes		
Maplewood:	5,267 Total	32 /staff	48/Facility sf
Elk River:	5,922 Total	49 /staff	43/Facility SF
Edina:	24,939 Total	50 /staff	
Bloomington:	17,974 Total	58 /staff	
Falcon Heights:	397 Total	24 /staff	

Opportunities for Reduction

The sections in this report summarizing each GHG inventory category include identification of potential opportunities for reduction. Though not comprehensive, these strategies represent municipal best practices which the City may benefit from continuing, expanding, or implementing. We have selected a few we believe the City may benefit from the most and have included them in Potential Next Steps for The City of Maplewood.

Executive Summary

Total City Emissions

487,020
Metric Tonnes

9,555,876,885
Cubic Feet of
Man-Made
Atmosphere



Volume Visualization

The graphic above represents the community wide volume of man-made GHG atmosphere produced annually by the City of Maplewood emissions totals. - seen here from the St Paul High Bridge 6.25 miles away. The volume of atmosphere is equal to a cube **2,122** feet on each face.

Potential Next Steps for the City of Maplewood

We recommend the City implement the following:

- 1) Engage a consultant to work with City to develop a GHG Reduction goal and action plan.
- 2) Maintain and update Community Wide and City Operations GHG inventory annually to track progress against energy and greenhouse gas reduction goals.
- 3) Engage a consultant for a detailed Facility Assessment, Energy Audit, and energy efficiency action plan for the City Hall/Police, Fire Station 7, and Community Center facilities.
- 4) Explore the feasibility of installation of additional renewable energy generation on one or more City facility
- 5) Explore potential of developing an Alternative Energy TIF district for redevelopment of target sites within the City.
- 6) Engage a consultant to develop a detailed sidewalk, bike lane, bike trail, tree and pollinator corridor and connectivity study.
- 7) Implement Public Transit Commuter Campaign building awareness among City staff by communicating public transit routes, establish carpool groups, and communicate reimbursement potentials available under December 2015 US Consolidated Appropriations Act (HR 2029)



Maplewood GHG Baseline Inventory

How does Community Wide Energy Use contribute to Greenhouse Gas Emissions?

Nationally, 12% of US GHG emissions originate from businesses and residents arising primarily from fossil fuels burned for heating and cooking. Another 30% of national GHG emissions are generated through the burning of fossil fuels for the production of electricity.

The burning of fossil fuels results in a range of pollution byproducts including Greenhouse Gases. When burned, per British Thermal Unit (Btu) of energy produced, fossil fuels emit between 117 pounds of CO2 for Natural Gas to 229 pounds CO2 for Coal.

The amount of GHG emissions associated with electricity use varies from region to region based on the mix of fuel used in each regional electrical grid. According to Xcel Energy public data, the emission factor for their electrical service within Minnesota is 1.04 pounds CO2 per Kwh.

Fuel Mix Comparison

This chart compares fuel mix (%) of sources used to generate electricity in your region to the fuel mix (%) for the entire United States.

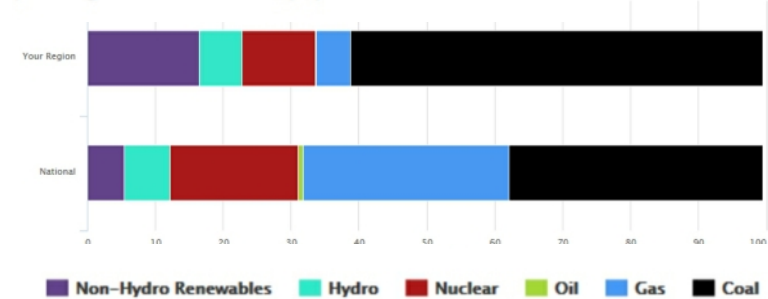
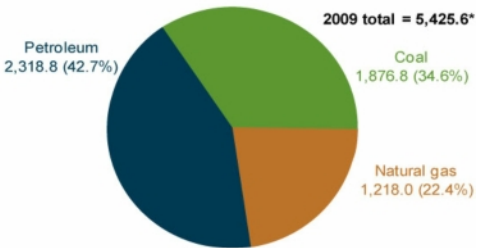


Figure 2. U.S. energy-related carbon dioxide emissions by major fuel, 2009
million metric tons carbon dioxide



Summary of findings*

Total actual annual energy consumption throughout the City of Maplewood was 3,218,415 MMBtu with 48% attributed to residential consumers and 52% commercial and industrial uses. Baseline GHG emissions associated with this community-wide energy consumption totals 270,111 Metric Tonnes (595,492,113 pounds) CO2 with 57% related to electricity consumption and 43% generated from natural gas usage.

On a per capita basis, energy consumption in Maplewood totals 50 MMBtu per resident, 65% of the State average of 77 MMBtu. Maplewood commercial and industrial energy consumption averaged 57 MMBtu per job compared to the State of Minnesota average of 66 MMBTU

When normalized for weather, total annual energy consumption throughout the City of Maplewood is adjusted downward 6.4% to an adjusted total of 3,012,575 MMBtu and a corresponding Weather Normalized Baseline GHG of 254,911 Metric Tonnes.

*As reported for 2013 in Regional Indicator's Initiative (<http://www.regionalindicatorsmn.com/>)
Sources: US Department of Energy (<http://apps1.eere.energy.gov/states/residential.cfm/state=MN>),
US NOAA (http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/degree_days/)

Community Wide Energy Use

Annual Greenhouse Gas equal to: 270,111 Metric Tonnes
5,299,879,805 Cubic Feet of Atmosphere



Volume Visualization

The graphic above represents the community wide volume of man-made GHG atmosphere produced annually by community wide building energy use - seen here from White Bear Lake and I-694 2.25 miles away. The volume of atmosphere is equal to a cube 1,744 feet on each face.

Opportunities for reduction

Alternative Energy TIF: Explore potential of developing an Alternative Energy TIF district for redevelopment of target sites within City, similar to the program established by the City of Chicago.

Community Solar: Conduct a study to determine potential neighborhoods/areas well suited for community solar. Support the development of Minnesota community solar submissions within City of Maplewood.

Sustainable Business Park: Explore the creation of a net zero business park focused on green product development, business incubation, and green job training for City of Maplewood residents. Sustainable Business Park can function as a regional demonstration project for energy reduction strategies. Target sites may include existing under performing "big box" retail spaces or warehouse buildings.


Maplewood GHG Baseline Inventory

How does Community Wide Travel and Transportation contribute to Greenhouse Gas Emissions?

Transportation sector GHG emissions in the United States for 2013 totaled 1,789,860,000 metric tonnes. Nationally, 26% of GHG emissions originate in the transportation sector.

Fossil Fuels used in transportation produce GHG when burned, primarily CO2. In fact, the weight of CO2 produced actually exceeds the weight of the fuel burned. The amount of GHG produced by common transportation fuels ranges from 19.4 pounds per gallon for gasoline to 21.5 pounds for jet fuel and 22.5 pounds for diesel.

How can GHG emissions weigh more than the fuel we burn



According to the US EPA:

The amount of carbon dioxide (CO2) that is produced from burning a fuel weighs more than the amount of the fuel itself, because during complete combustion, each carbon atom in the fuel combines with two oxygen atoms in the air to make CO2. The addition of two oxygen atoms to each carbon atom forms CO2, which has an atomic weight of 44—roughly 3.6667 times the atomic weight of the carbon, which is 12.

Summary of findings*

Community wide, baseline Vehicle Miles Total (VMT) for the City of Maplewood total 346,248,490 miles on all roads including Interstate, State, County, and Municipal roads. Currently, there is no tracking methodology for air travel associated by a community. Consistent with ICLEI protocol, the community wide share of airport emissions, are assumed to be equal to the community's share of metro-wide homebased vehicle trips. The City of Maplewood's share of homebased vehicle trips, and airport travel, are equal to 1.2% of metro total.

Primary community-wide transportation emissions for the City of Maplewood come from road vehicles and City share of regional air traffic. Road vehicle emissions account for 81.8% of this total (167,056 Metric Tonnes) while the community's share of regional air travel represents 18.2% (37,156 Metric Tonnes). The total community wide annual Baseline Transportation emissions total 204,212 Metric Tonnes, or 5.24 metric tonnes per capita, 7.4% less than the national average.

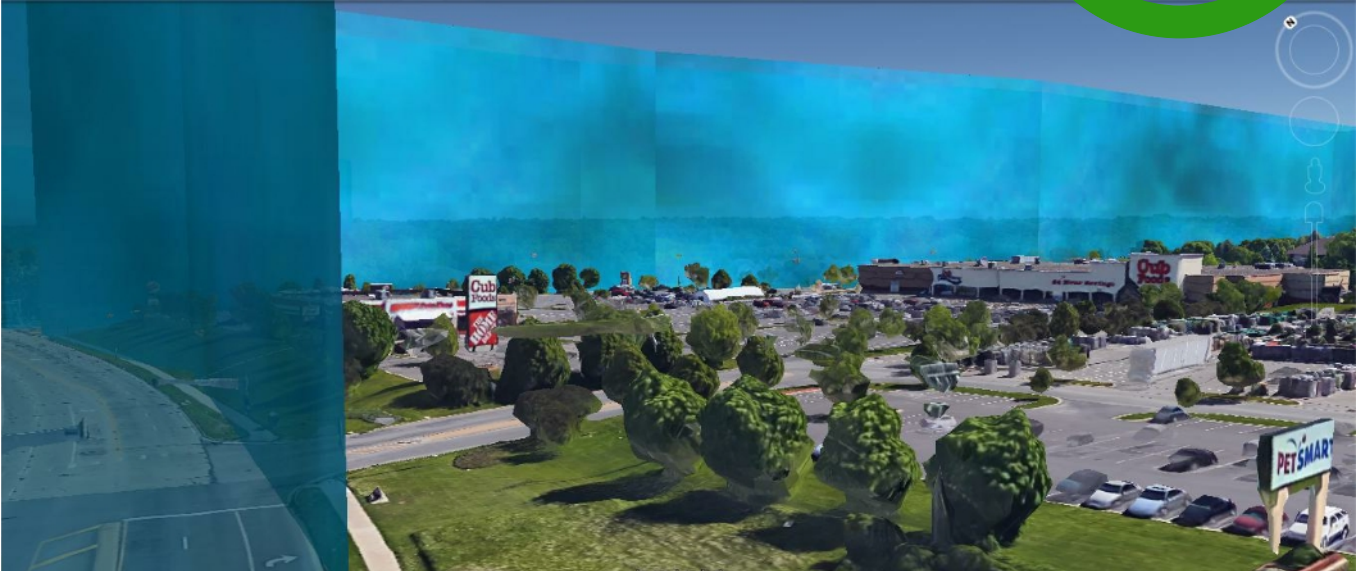
*As reported for 2013 in Regional Indicator's Initiative (<http://www.regionalindicatorsmn.com/>)

Community Wide Travel and Transportation

Annual Greenhouse Gas equal to:

204,212
Metric Tonnes

4,006,867,749
Cubic Feet of
Atmosphere



Volume Visualization

The graphic above represents the community wide volume of man-made GHG atmosphere produced annually by community transportation and travel - seen here from White Bear Lake and highway 36. The volume of atmosphere would cover all 268 lane-miles of streets within the City to a depth of over **258** feet.

Opportunities for reduction

Alternative Transportation Planning: Engage a consultant to develop a detailed sidewalk, bike lane, bike trail, tree and pollinator corridor and connectivity study. Study should focus on defining strong existing routes connecting residents with employment, commercial, and recreational zones as well as identify connectivity gaps or under leveraged opportunities.

Nice Ride: Engage Nice Ride Minnesota to develop bike rental locations at strategic locations connecting bike trails, commercial corridors, residential sectors, and transit lines.

Promotion: Explore additional ways to define and promote existing alternative transportation paths and methods to city businesses and residents. Strategies may include printed bike/walkway/bus line maps and interactive website.



Maplewood GHG Baseline Inventory

How does Community Wide Water Use contribute to Greenhouse Gas Emissions?

Water and energy use are inextricably linked in modern cities. Energy is required to extract, treat, and distribute water to residences and businesses. Nationally, the United States consumes over 355 billion gallons of water daily, requiring an estimated 500 billion kwh annually to distribute to users. Globally, water treatment and distribution is estimated to contribute 2-3% of total greenhouse gas emissions annually.



Summary of findings*

Ramsey County uses nearly 22 billion gallons of water annually, averaging 118 gallons of water used per person per day. Meanwhile, the total water consumption for the City of Maplewood baseline year 2013 accounted for 8.4% of Ramsey County's water use – roughly the equivalent of 2,900 Olympic sized swimming pools. Maplewood's city-wide water use of 1,851,581,174 gallons represents an average water consumption of 130 gallons per person per day, or approximately 110% of the County's average.

Most of the water consumed in the City of Maplewood is provided by Saint Paul Regional Water Services. For the 2013 baseline year, the Saint Paul Regional Water Services used 20,434,560 KWH to pump 15.5856 billion gallons to their customers, resulting in an average greenhouse gas emission of 0.025 ounces CO2e per gallon of water consumed. Consequently, the total community wide annual baseline water consumption related emissions total 2,832,919 pounds (1,285 Metric Tonnes) CO2e, or 72.7 pounds per Maplewood resident annually.

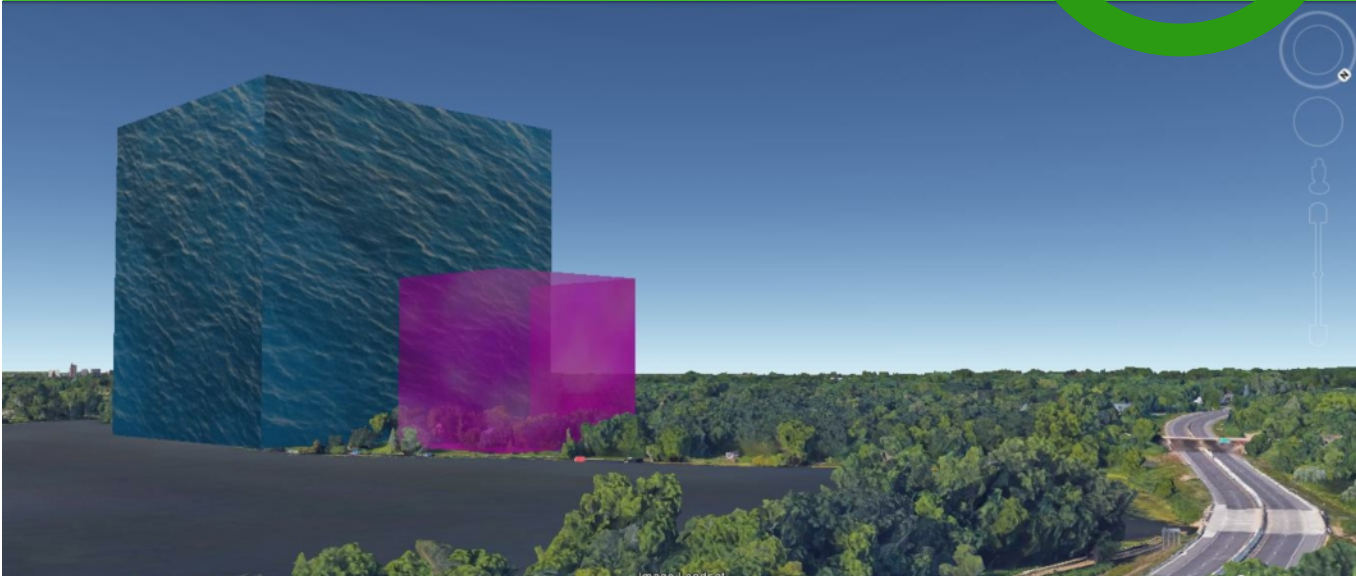
*As reported for 2013 in Regional Indicator's Initiative (<http://www.regionalindicatorsmn.com/>)
Sources: Saint Paul Regional Water Services energy and total production volume data.

Community Wide Water Use

Annual Greenhouse Gas equal to:

1,285
Metric Tonnes

25,213,137
Cubic Feet of
Atmosphere



Volume Visualization

The graphic above represents the community wide volume of water consumed (blue mass) and the associated man-made GHG atmosphere produced annually (purple mass) - seen here at Keller Lake near Highway 36.

Opportunities for reduction

Fixture Efficiency: Explore partnering with water utility to create a toilet replacement program supporting discounts for replacing high water use toilets with high efficiency EPA qualified fixtures.

Public Awareness: Develop water conservation public awareness campaign
Encourage installation of rainwater collection for out-door water use.



Maplewood GHG Baseline Inventory

How does Community Wide Solid Waste contribute to Greenhouse Gas Emissions?

According to US EPA studies, traditional waste management contributes 1-5% of our collective GHG emissions in the United States. The processing and treatment of waste can produce emissions of several of the greenhouse gases. Even recycling of waste produces some greenhouse gas emissions, however, these are usually offset by the reduction in fossil fuel use that would be required to create a similar amount of product from raw resources.

The most prevalent greenhouse gas produced through municipal solid waste is the methane released during the breakdown of organic matter in landfills. Pound for pound, the cumulative climate change effect of methane is 25 times more potent than that of carbon dioxide.

The U.S. has 3,091 active landfills and the EPA estimates there are over 10,000 old municipal landfills no longer receiving material. The average American produces 3.5 pounds of trash daily. With a total population of nearly 320 million people, the United States produces approximately 19 billion cubic feet of trash annually.

Summary of findings*

Community wide, the City of Maplewood produces an estimated 45,188 tons of municipal solid waste (MSW) annually. Approximately 51% of this total waste, an average of nearly 54 pounds per residence every month, is diverted through recycling and re-enters the supply chain. In addition, another 32% is sent to the Ramsey County RDF (refuse derived fuel) facility and is incinerated for energy. The remaining 17% is deposited in landfills. It should be noted that this diversion of MSW from landfills is a significant improvement over the national average of 53% MSW deposited in landfills.

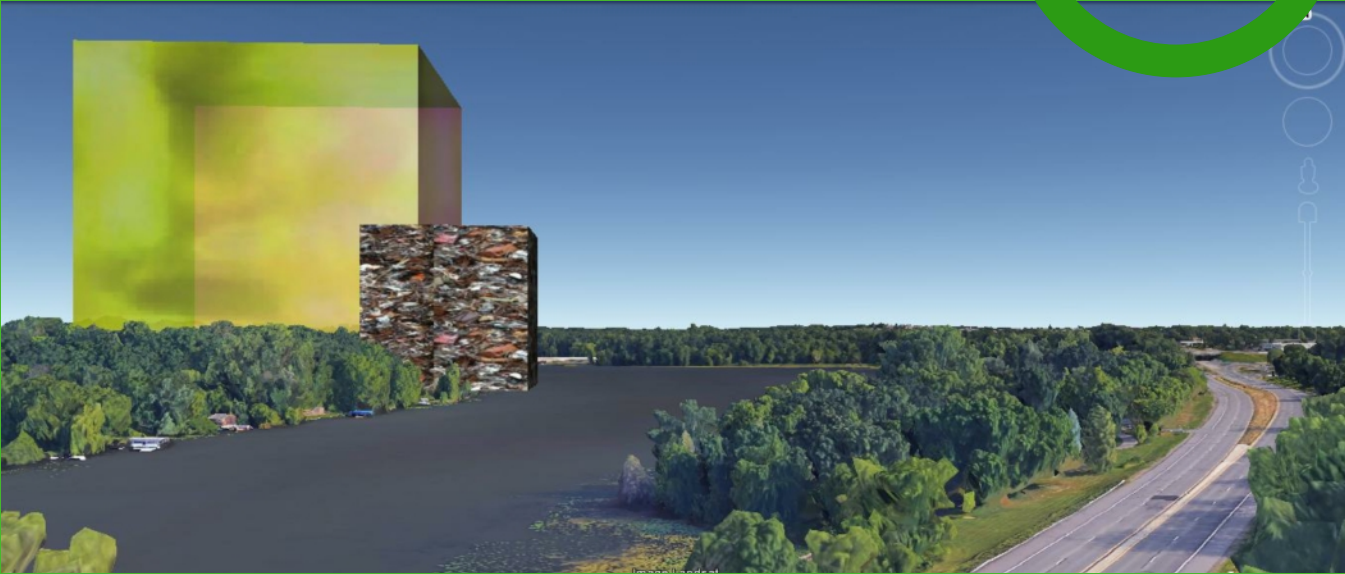
2015 baseline GHG emissions associated with the community wide City of Maplewood waste totals 8,654 metric tonnes CO₂e (19,078,782 pounds). Approximately 62% of those total GHG emissions are associated with the combustion of waste products at the RDF facility while the remaining 38% are associated with emissions not yet captured at landfill sites.

*As reported for 2013 in Regional Indicator's Initiative (<http://www.regionalindicatorsmn.com/>)
Sources: County Certification Annual Reports and MPCA annual SCORE reports: (<https://www.pca.state.mn.us/quick-links/recycling-and-solid-waste-data>)

Community Wide Solid Waste

Annual Greenhouse Gas equal to: **169,801,155**
Cubic Feet of Atmosphere

8,654
Metric Tonnes



Volume Visualization

The graphic above represents the community wide volume of municipal solid waste generated and the associated man-made GHG atmosphere produced annually (yellow mass) - seen here at Keller Lake near Highway 36. The emissions would fill a volume of atmosphere equal to a cube **554** feet per face

Opportunities for reduction

- Explore development or support of training programs for hybrid deconstruction techniques as an alternative to traditional demolition of residential and small commercial structures
- Explore development of a "Pay-as-you-throw" waste system with City trash haulers in which businesses and residents pay waste disposal charges based on quantities rather than flat rates.
- Explore development of food waste collection and composting with city restaurants and residents.



Maplewood GHG Baseline Inventory

How does Community Wide Waste Water contribute to GHG Emissions?

As with water processing and distribution, Wastewater collection and treatment requires energy inputs. With our current energy grid, those energy inputs are significantly fossil fuel based.

In addition to emissions associated with fossil fuel use, wastewater treatment produces significant “Biogenic” emissions associated with the microbial processing of the waste solids. The primary gas emitted during biological nitrogen removal is Nitrous Oxide (N2O), a greenhouse gas with a potency roughly 300 times that of CO2. With such potency and an observed increase of atmospheric N2O of over 17%, ongoing studies by the US EPA and Intergovernmental Panel on Climate Change (IPCC) continue to refine understanding of the origins, impacts, and reduction strategies for wastewater N2O emissions.

For the purposes of GHG calculations for community carbon footprint reporting, these “Biogenic” emissions are considered to be a part of the biological carbon cycle and are not currently included in the GHG totals. Protocols may change in the future to include wastewater Biogenic N2O emissions.

Summary of findings*

Wastewater for the City of Maplewood is collected and treated by the Metropolitan Council Environmental Services division (MCES). MCES provides wastewater collection and treatment service for almost 2.7 million residents in 108 communities in the Twin Cities region. MCES treats an average of 250 million gallons of water daily, and for the 2013 baseline year treated a total of 88.4 billion gallons of wastewater.

Wastewater attributable to the City of Maplewood for the baseline year 2013 totaled 1,350,600,000 gallons, an average of 95 gallons per person per day. MCES fossil fuel emissions associated with City of Maplewood wastewater totaled 2,759 metric tonnes (6,082,546 pounds) CO2e.

In addition to fossil fuel emissions, Biogenic emissions associated with City of Maplewood wastewater treatment for the same year totaled 2,575 metric tonnes. These Biogenic emissions, however, are not currently included in the community wide GHG totals as per protocol standard.

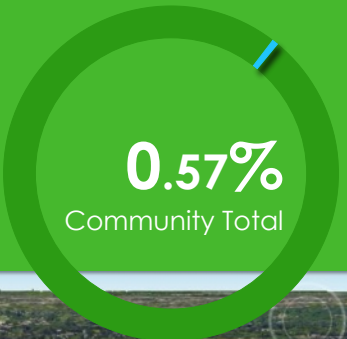
*As reported for 2013 in Regional Indicator's Initiative (<http://www.regionalindicatorsmn.com/>)
Sources: Metropolitan Council Environmental Services, Linda Henning, Special Projects Manager. Emissions data is consistent with that reported to The Climate Registry. The plant emissions attributable to the City are based on the percentage of wastewater treated at the plant that is attributable to the City

Community Wide Waste Water

Annual Greenhouse Gas equal to:

2,759
Metric Tonnes

54,134,664
Cubic Feet of
Atmosphere



Volume Visualization

The City of Maplewood produces 1,350,600,000 gallons of wastewater annually. This volume of waste water is enough to fill Keller Lake over **8x**



Maplewood GHG Baseline Inventory

Total Community Wide Greenhouse Gas Emissions

GHG emissions for the 2013 baseline year total 487,021 metric tonnes (1,073,694,032 pounds) CO₂e. This represents a per capita emission of 12.12 metric tonnes.*

Energy Use	270,111 Metric Tonnes	(55.46%)
Travel and Transportation	204,212 Metric Tonnes	(41.93%)
Water Use	1,285 Metric Tonnes	(0.26%)
Solid Waste	8,654 Metric Tonnes	(1.78%)
Wastewater	2,759 Metric Tonnes	(0.57%)
Total:	487,021 Metric Tonnes	

Summary of findings*

The total GHG emissions captured by the Regional Indicators Initiative program do not include indirect emissions associated with food and product purchases, or with services provided residents and businesses outside of City boundaries. For the average American, these additional GHG emissions total 7.2 metric tonnes. If these indirect emissions were included, the likely total community wide GHG emissions would total 767,460 metric tonnes, or 19.7 metric tonnes per capita.

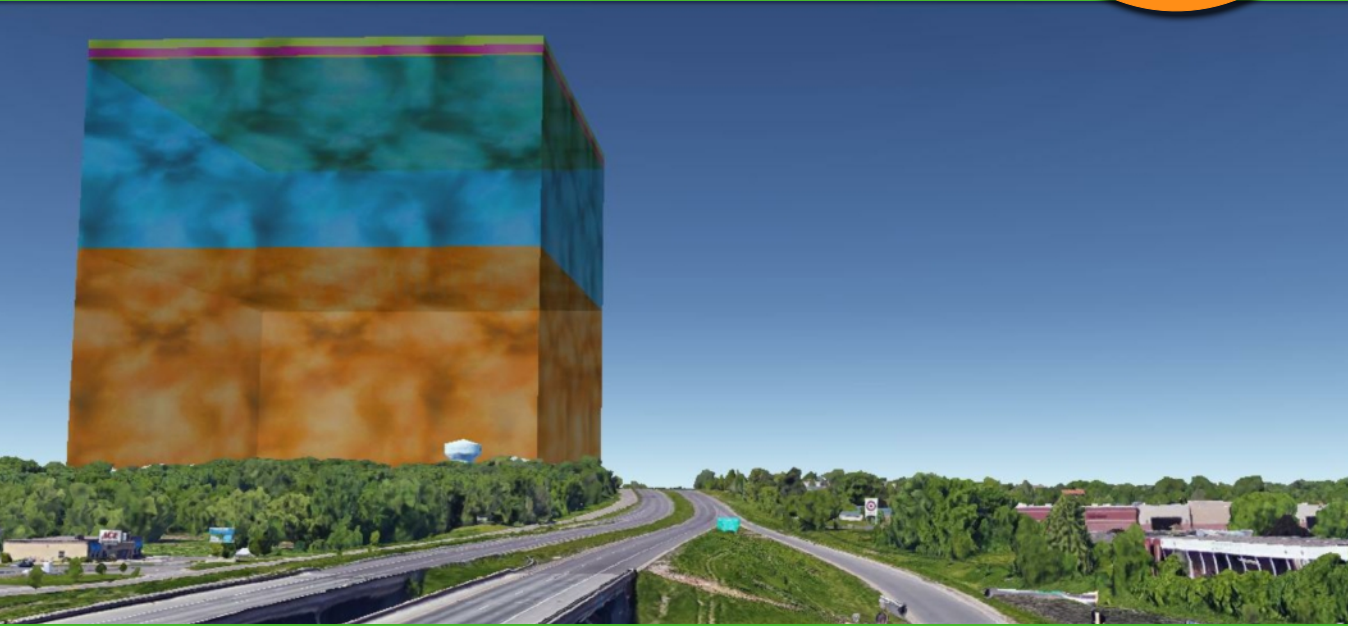
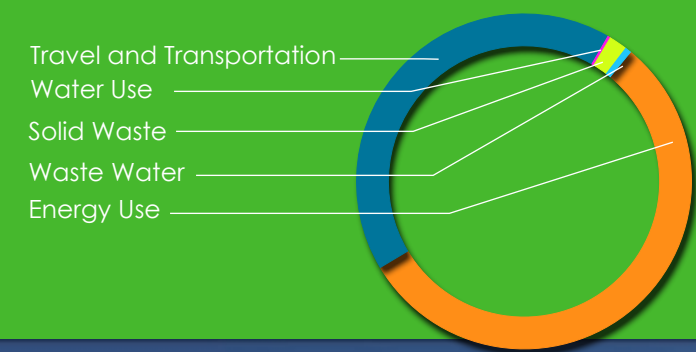
For more information on the breakdown of the average American resident's GHG emissions, you can view the article and infographic by paleBLUEdot LLC available at <http://www.bluedotregister.org/carbon-copy/2015/2/28/the-atmosphere-we-create-the-typical-american-carbon-footprint>.

Community Wide Total

Annual Greenhouse Gas equal to:

487,021
Metric Tonnes

9,555,896,509
Cubic Feet of Atmosphere



Volume Visualization

The graphic above represents the community wide volume of man-made GHG atmosphere produced annually by the City of Maplewood emissions totals. - seen here from McKnight and Minnesota 36 1.5 miles away. The volume of atmosphere is equal to a cube **2,122** feet on each face.



Maplewood GHG Baseline Inventory

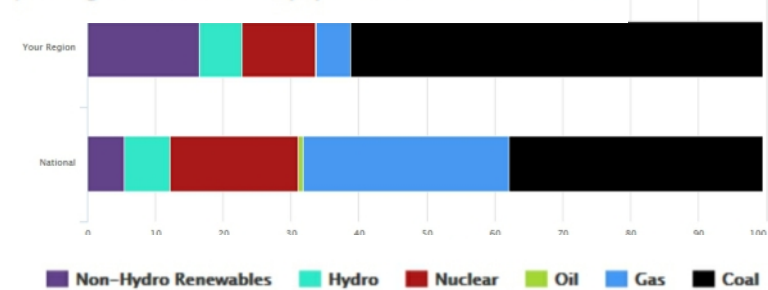
How do City Operated Buildings and Grounds contribute to Greenhouse Gas Emissions?

According to the US Department of Energy, use for buildings accounts for 41% of the total US energy consumption nationally. Building heating and cooling, lighting, and electronic equipment use makes up nearly 70% of all commercial building energy use. In the two decades between 1980 and 2009, the total energy consumed by our buildings increased 49%.

Greenhouse gas emissions associated with that building energy use comes from direct emissions of fossil fuels burned on site (natural gas, fuel oil, etc), as well as indirectly from fossil fuels burned to create electricity off-site. The greenhouse gas emissions factor associated with on-site fuel use is directly related to the carbon content of the fuels burned (see Community Wide Energy Use for fuel factors). The emissions factor associated with electricity use varies based on the raw fuel sources used by the electrical utilities supplying the local electrical grid – utility providers who source more of their power through renewable energy sources, have commensurately lower GHG emission factors.

Fuel Mix Comparison

This chart compares fuel mix (%) of sources used to generate electricity in your region to the fuel mix (%) for the entire United States.



Summary of Findings*

For the City Operations Baseline year of 2015, the eight City of Maplewood buildings reporting to B3 Benchmarking consumed a total of 3,445,336 kwh of electricity and 202,114 therms of natural gas. This relates to an average Energy Use Intensity (EUI) of 134.25 kBTU's per square foot of building space. According to the State's B3 Benchmarking system, on a building by building basis this EUI performance ranges from 5th percentile performance (City Hall) to 72nd percentile performance (South Fire Station). When compared against the EPA's Energy Star EUI reference index, the City of Maplewood's total facility EUI is 171% of the median EUI of 78.8.

The GHG emission associated with City of Maplewood buildings and grounds energy use for the Baseline year of 2015 totaled 3,503.3 Metric Tonnes (7,723,445 pounds) CO₂e. Total GHG emissions equal 32.17 pounds CO₂e per facility square foot per year. Emissions associated with electricity use were 60.4% while natural gas use emissions equaled 39.6% of the total GHG emissions.

When Normalized for Weather, total annual energy consumption for City of Maplewood buildings and grounds is adjusted downward 2% for electricity and upward 10% for natural gas. The resulting Weather Normalized annual Building and Grounds GHG increases 1.8% to a total of 3,566.7 Metric Tonnes.

* Sources: energy consumption as reported on B3 Benchmarking, emission factors based on US EPA and Excel Energy.

Opportunities for Reduction

The City of Maplewood has already engaged in a number of efforts aimed at reducing the energy consumption of existing City owned facilities. The City's newest facility constructed, the South Fire Station, was designed with a specific intent to improve energy efficiency, and with EUI performance in the 72nd percentile that facility is a successful step forward.

Based on the energy reporting of all city facilities, however, there are opportunities both for energy efficiency improvement and operational cost savings. A focus on reducing the total energy consumption of the City's three largest facilities (City Hall, Public Works, and the Community Center) could significantly increase City Operation energy efficiency. According to B3 Benchmarking, improving the energy performance of these three facilities to an EUI performance meeting national medians for facility type could decrease annual operating costs up to \$150,000.

Recommendations:

- Assess all existing buildings for compliance with the City's Green Building Code.
- Engage a consultant team to conduct a detailed Facility Assessment and Energy Audit and develop an energy efficiency action plan for the City Hall, Public Works, and Community Center facilities.



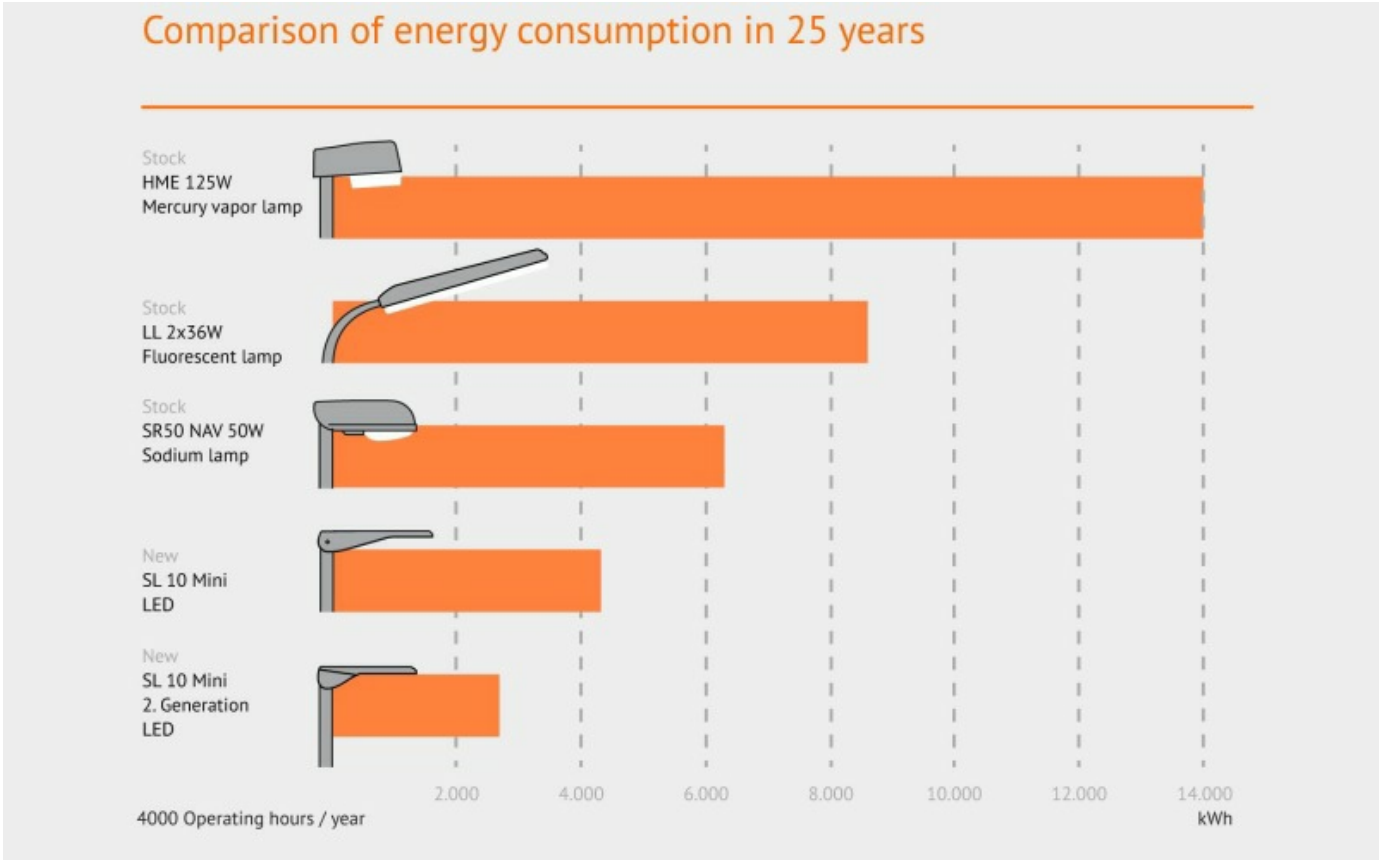
Maplewood GHG Baseline Inventory

How do City Streetlights and Signals contribute to Greenhouse Gas Emissions?
As with Buildings and Grounds, the electricity used to supply our street lighting is a source of Greenhouse Gas. The emissions factor associated with electricity use varies based on the raw fuel sources used by the electrical utilities supplying the local electrical grid – utility providers who source more of their power through renewable energy sources, have commensurately lower GHG emission factors.

According to a 2011 study by the Lighting Research Center, on average, municipal lighting uses 4 kwh per mile of street light coverage. Assuming an average of 4,300 hours of operation annually, that represents 17,520 kwh of energy use and a GHG emission of 12.37 Metric Tonnes (12,271 pounds) of CO2e annually per mile of street lighting.

Summary of Findings*
For the City Operations Baseline year of 2015, the Xcel Energy reports a total electrical use of 571,872 kwh for City of Maplewood owned streetlights and signals. The GHG emission associated with City of Maplewood Streetlight energy use for the Baseline year of 2015 totaled 403.62 Metric Tonnes (889,828 pounds) CO2e.

* Sources: City of Maplewood and Elk River Municipal Utilities data, emission factors based on US EPA and Xcel Energy,



Opportunities for Reduction
According to a 2012 Minnesota Department of Commerce study, switching from HPS to LED luminaires typically produces 40% to 60% savings in electricity consumption if the system is properly designed. In addition, wireless control and monitoring systems can allow the city to implement dimming strategies that may reduce street lighting energy consumption by another 10-20%.

By converting from HPS to LED street lighting fixtures, energy consumption associated with street lighting should be reduced by 180,000 to 270,000 kwh annually. This reduction in energy consumption would mean a reduction of 127 to 190 Metric Tonnes of CO2e annually.

City Operations Streetlights and Signals

Annual Greenhouse Gas equal to:

403.62
Metric Tonnes

7,919,
Cubic Feet of
Man-Made
Atmosphere

7.66%

City Operations
Total

Operations of City of Maplewood streetlights and signals produces a volume of greenhouse gas equal to:

522

Cubic Feet of man-made Atmosphere annually For every family in Maplewood (Figure to scale)



Maplewood GHG Baseline Inventory

How do City Vehicles contribute to Greenhouse Gas Emissions?

Fossil Fuels used in transportation produce GHG when burned, primarily CO2. In fact, the weight of CO2 produced actually exceeds the weight of the fuel burned. The amount of GHG produced by common vehicle fuels ranges from 19.4 pounds per gallon for gasoline to 22.5 pounds for diesel.

Nationally, Americans drive over 3 trillion miles annually, producing 1.2 billion Metric Tonnes of vehicle related GHG emissions.*

*For more information: <http://www.bluedotregister.org/carbon-copy/2014/12/11/a-mountain-of-an-impact-the-carbon-footprint-of-american-roads>

How can GHG emissions weigh more than the fuel we burn



According to the US EPA:

The amount of carbon dioxide (CO2) that is produced from burning a fuel weighs more than the amount of the fuel itself, because during complete combustion, each carbon atom in the fuel combines with two oxygen atoms in the air to make CO2. The addition of two oxygen atoms to each carbon atom forms CO2, which has an atomic weight of 44—roughly 3.6667 times the atomic weight of the carbon, which is 12.

Summary of Findings*

The City of Maplewood owns and operates vehicles as a critical support to functions in Police, Fire, Public Works, Parks, and City Administration functions. During the 2015 Baseline year, the City's vehicle fleet used 45,064 gallons of gasoline and 94,135 gallons of diesel fuel. The emissions volume associated with the fleet's fuel consumption totaled 899.6 Metric Tonnes (1,983,276 pounds) CO2e, approximately 0.54% of community wide vehicle emissions.**

* Sources: City of Maplewood data, emission factors based on US EPA and EIA.
**Based on Regional Indicators Initiative data.

Opportunities for Reduction

Recommendations from Greenstep Cities offer a range of best practice concepts which can greatly reduce municipal fleet fuel consumption when implemented and reviewed regularly for continued advancement. Best practices which the City of Maplewood may be able to leverage for continued fuel efficiency include:

Efficiently use existing fleet of city vehicles by encouraging trip bundling, video conferencing, carpooling, vehicle sharing and incentives/technology.

No-Idling practices and policies

Vehicle replacement plan to migrate to electric and hybrid vehicles.

Optimize street maintenance and snow plowing routes for highest fuel economy.

Explore Efficiency Programs focused on diesel engine retrofits, installation of auxiliary power units

Conduct a Sidewalk and Trails study to identify opportunities to encourage and increase biking and walking as transit options both for city employees as well as the public.

City Operations City Vehicles

Annual Greenhouse Gas equal to:

899.60
Metric Tonnes

17,651,067
Cubic Feet of
Man-Made
Atmosphere



Operations of City of Maplewood vehicles generates a volume of greenhouse gas per municipal road mile equal to

185,801
Cubic feet.

Municipal streets within the City of Maplewood total

95
Road Miles

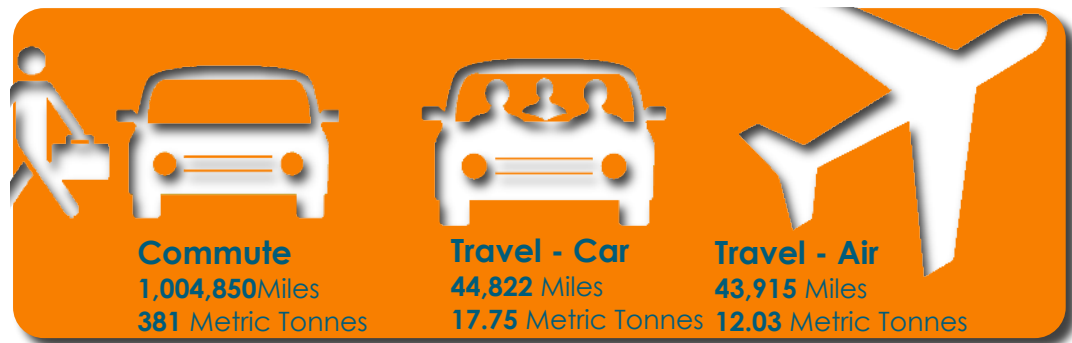


Maplewood GHG Baseline Inventory

How does City Employee Transportation contribute to Greenhouse Gas Emissions?

The City's operational travel and transport emissions come from three primary sources: employee commute to and from work, auto-oriented business travel within region, and business air travel regionally/nationally.

As with the City Vehicle sector of City Operations GHG emissions, employee travel to and from work and required business travel regionally and out of state require fossil fuel use. The amount of GHG produced by common transportation fuels ranges from 19.4 pounds per gallon for gasoline to 21.5 pounds for jet fuel and 22.5 pounds for diesel.



Summary of Findings*

According to the City's 2015 employee commuter survey, the average round-trip employee commute distance is 24.36 compared with the estimated community-wide average of 38 miles. City employee work commutes are primarily in single occupant vehicle (97.28%), while 1% occurs in carpools, and 1.72% via biking or walking. Total annual vehicle miles traveled for City employee commute is calculated at 977,518 miles for single occupant and 10,049 miles for carpooling. Total City employee commuter emissions for the 2015 Baseline year equal 381 Metric Tonnes (839,960 pounds) CO₂e.

Business travel through the Baseline 2015 year totaled 45,822 miles for road transportation and 43,915 miles for air transportation. Total annual emissions associated with this business travel equal 30 Metric Tonnes (66,138 pounds) CO₂e.

The 411 Metric Tonnes associated with these three City Operations travel and transportation equal 0.20% of Community Wide travel and transportation emissions.**

* Sources: City of Maplewood data, emission factors based on US EPA and EIA. Calculations for car business travel were calculated based on current reimbursement rates. Calculations for air business travel were calculated based on national average cost-per-mile data <http://airlines.org/data/annual-round-trip-fares-and-fees-domestic/>
**Source Regional Indicators Initiative.

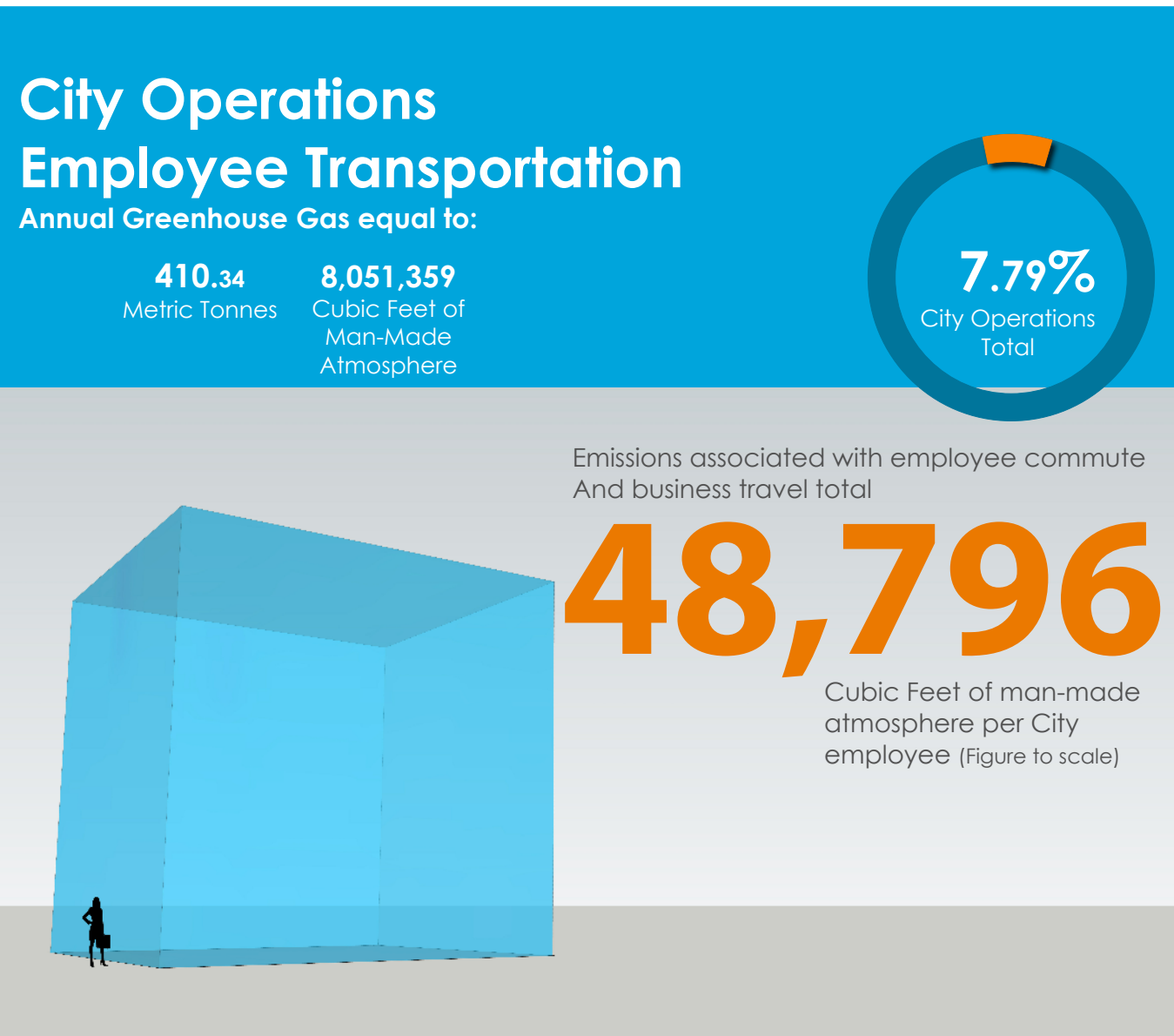
Opportunities for Reduction

Business Travel Optimization by encouraging trip bundling, video conferencing, carpooling, vehicle sharing and incentives/technology.

Explore Partnership with Nice Ride Minnesota for installation of bike sharing locations convenient to city staff as well as community members as strategy to increase commute via public transit and bike.

Implement Public Transit Commuter Campaign by building awareness through communicating public transit routes, establish carpool groups, and communicate reimbursement potentials available under December 2015 US Consolidated Appropriations Act (HR 2029)

Employee Green-Commuter Incentives Explore incentives for employee green-commuters such as buss passes, insurance premium reductions for walking/biking to work, etc.



Maplewood GHG Baseline Inventory

How do the provision of Water and Wastewater Utilities contribute to Greenhouse Gas Emissions?

Water and energy use are inextricably linked in modern cities. Energy is required to extract, treat, and distribute water to residences and businesses. Nationally, the United States consumes over 355 billion gallons of water daily, requiring an estimated 500 billion kwh annually to distribute to users. Globally, water treatment and distribution is estimated to contribute 2-3% of total greenhouse gas emissions annually.

As with water processing and distribution, Wastewater collection and treatment requires energy inputs. With our current energy grid, those energy inputs are significantly fossil fuel based.

In addition to emissions associated with fossil fuel use, wastewater treatment produces significant “Biogenic” emissions associated with the microbial processing of the waste solids. The primary gas emitted during biological nitrogen removal is Nitrous Oxide (N2O), a greenhouse gas with a potency roughly 300 times that of CO2. With such potency and an observed increase of atmospheric N2O of over 17%, ongoing studies by the US EPA and Intergovernmental Panel on Climate Change (IPCC) continue to refine understanding of the origins, impacts, and reduction strategies for wastewater N2O emissions.

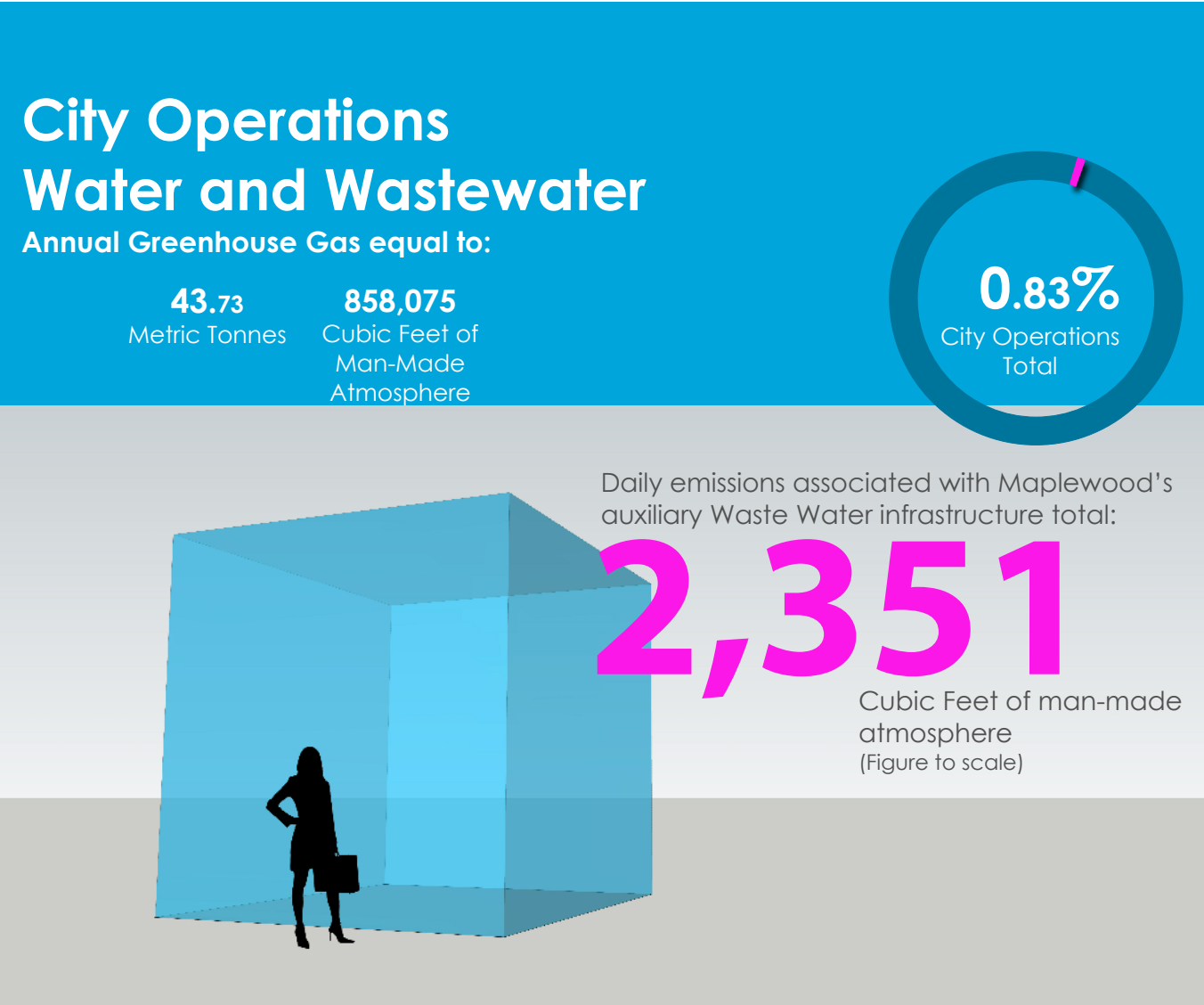
For the purposes of GHG calculations for community carbon footprint reporting, these “Biogenic” emissions are considered to be a part of the biological carbon cycle and are not currently included in the GHG totals. Protocols may change in the future to include wastewater Biogenic N2O emissions.

Summary of Findings*

The City of Maplewood operates neither a wastewater treatment facility, nor a water utility. Within the City, wastewater treatment is provided by the Metropolitan Council, while water is provided by Saint Paul Regional Water Services (SPRWS). The community’s share of both the Met Council’s wastewater treatment as well as SPRWS’s emissions are included in the Community Wide GHG Inventory.

The City does, however, operate pump and lift stations to augment water distribution as well as wastewater collection within the boundaries of the City. These 11 stations consume a total of 61,962 kwh annually, generating a total of 43.72 Metric Tonnes (96,386 Pounds) CO2e

* Sources: energy consumption as reported by City of Maplewood, emission factors based on US EPA and Excel Energy,

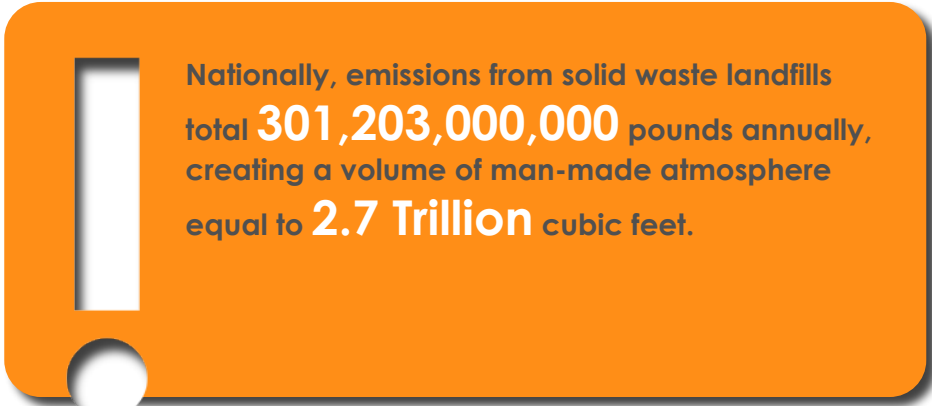


Maplewood GHG Baseline Inventory

How does City Operations Solid Waste contribute to Greenhouse Gas Emissions?

According to US EPA studies, traditional waste management contributes 1-5% of our collective GHG emissions in the United States. The processing and treatment of waste can produce emissions of several of the greenhouse gases. Even recycling of waste produces some greenhouse gas emissions, however, these are usually offset by the reduction in fossil fuel use that would be required to create a similar amount of product from raw resources.

The most prevalent greenhouse gas produced through municipal solid waste is the methane released during the breakdown of organic matter in landfills. Pound for pound, the cumulative climate change effect of methane is 25 times more potent than that of carbon dioxide. Additionally, municipal solid waste is frequently combusted, which produces CO2 as well as nitrous oxide (N2O) which is 298 times more potent than CO2 as a greenhouse gas.



Summary of Findings*

The volume of the City facilities' solid waste are not currently measured by the City's waste handler. Annual recycling collections per City owned building are reported in Tennis Sanitation's annual recycling report. Using this data and community wide averages for recycling share of total municipal solid waste handled, the total municipal solid waste (MSW) from City facilities can be estimated.

MSW handled from City of Maplewood facilities for Baseline year 2015 totaled 35.61 tons, or 432 pounds of waste annually per City employee (FTE). Using the community wide blended GHG factor for MSW handled, the GHG emissions associated with City of Maplewood facility waste handled totals 6.82 Metric Tonnes (15,036 pounds) CO2e.

* Sources: Total waste handled data, and community waste characteristics based on Regional Indicators Initiative and MPCA. Blended emission factor per ton MSW handled based on Regional Indicators Initiative.

Opportunities for Reduction

Based on the March 2016 waste sort of City facilities provided by Waste Wise, 53% of facility waste is compostable, 17% is recyclable, and 4% is reusable. Although this study represents a "snapshot" of waste collected over just one week, it offers guidance on where efforts within City operations may best focus:

Compostable Waste: Develop a compostable waste collection program for city facilities and implement in conjunction with an educational/awareness campaign to alert facility users to the role of composting. Composting program may include traditional compost collection (including compostable paper) as well as compost collection systems capable of handling range of food waste including meat.

Paper Use Reduction: Develop policies focused on reduction of office paper use. Tips to consider for inclusion can be found at MPCA. Policies implemented should include office paper use tracking and reporting to employees, encouraging and rewarding continued improvement.



Maplewood GHG Baseline Inventory

City Operations Greenhouse Gas Emissions

GHG emissions for the 2015 City Operations Baseline year total 5,267.41 Metric Tonnes (11,612,637 pounds) CO₂e, an emission rate of 31.92 Metric Tonnes per employee (FTE), or 48.37 pounds CO₂e per City facility per year. The City Operations total GHG emissions represent 1.08% of Maplewood community-wide GHG emissions. City Operation emissions are as follows:

City Buildings and Grounds	3,503.30 Metric Tonnes	(66.51%)
Streetlights and Signals	403.62 Metric Tonnes	(7.66%)
City Vehicles	899.60 Metric Tonnes	(17.08%)
Employee Travel and Transportation	410.34 Metric Tonnes	(7.79%)
Water and Wastewater	43.73 Metric Tonnes	(0.83%)
Solid Waste	6.82 Metric Tonnes	(0.13%)
Total:	5,267.41 Metric Tonnes	(100%)

* Community Wide total as reported by Regional Indicators Initiative

Indirect GHG Emissions Not Included

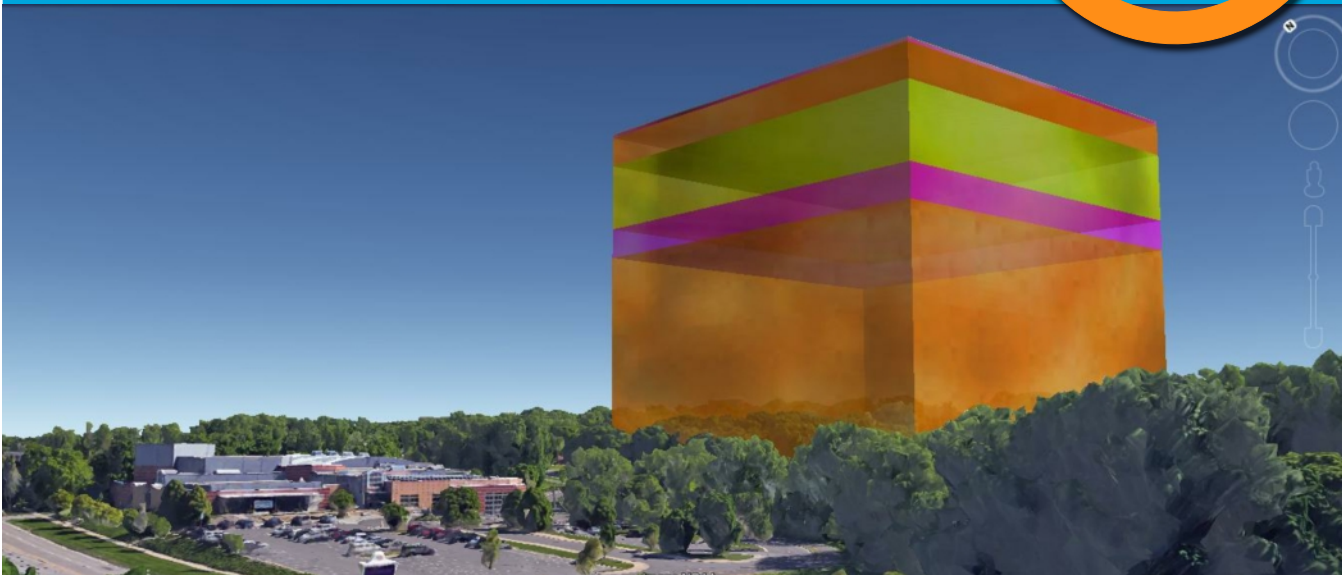
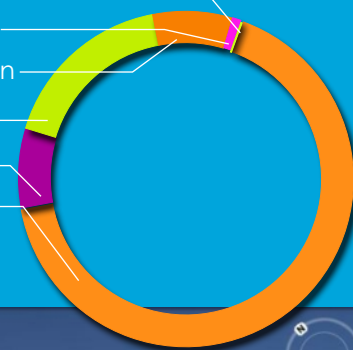
The total GHG emissions captured by this assessment do not include indirect emissions associated with city food and product purchases, or with services provided to the City of Maplewood such as professional consulting. On average, indirect full supply chain emissions associated with products and services purchased equal 1 pound of CO₂e per dollar spent.

City Operations Total

Annual Greenhouse Gas equal to:

5,267.41 **103,352,455**
Metric Tonnes Cubic Feet of
Man-Made
Atmosphere

Solid Waste
Water and Wastewater
Employee Transportation
City Vehicles
Streetlights and Signals
Buildings and Grounds



Volume Visualization

The graphic above represents the volume of man-made GHG atmosphere produced annually by the City of Maplewood operations, broken down by category, shown in scale with Maplewood Community Center.



Maplewood GHG Baseline Inventory



City Operations Carbon Baseline
Buildings and Grounds

Facility	2015 Baseline	% Total	
Electricity Use			
Base Accounts (actual)	KWH		
City Hall / Police Station	800,677.65	23.24%	
Fire Station 2	114,865.88	3.33%	
Fire Staiton 7	52,410.76	1.52%	
McKnight Station	93,529.41	2.71%	
Community Center	2,008,151.88	58.29%	
Nature Center	19,535.72	0.57%	
Parks and Recreation	46,945.88	1.36%	
Public Works	309,219.00	8.98%	
Subtotal Base Accounts	3,445,336.19	100.00%	
New Accounts (actual)			
Subtotal New Accounts	0.00	0.00%	
Total Electrical Use (actual)	3,445,336.19	100.00%	
Natural Gas Use			
Base Accounts (actual)	Therms		
City Hall / Police Station	47,283.59	23.39%	
Fire Station 2	5,546.06	2.74%	
Fire Staiton 7	6,204.24	3.07%	
McKnight Station	8,897.12	4.40%	
Community Center	90,059.80	44.56%	
Nature Center	1,340.58	0.66%	
Parks and Recreation	6,110.82	3.02%	
Public Works	36,672.24	18.14%	
Subtotal Base Accounts	202,114.44	100.00%	
New Accounts (actual)			
Subtotal New Accounts	0.00	0.00%	
Total Natural Gas Use (actual)	202,114.44	100.00%	
Energy Use Intensity (EUI)			
Base Accounts (actual)	Building Area (sF)	Total KBTU	EUI
City Hall / Police Station	47,480	7,590,995.51	159.88
Fire Station 2	10,403	946,528.27	90.99
Fire Staiton 7	5,818	799,249.06	137.38
McKnight Station	17,673	1,208,834.12	68.40
Community Center	86,144	15,988,992.11	185.61
Nature Center	3,030	200,714.31	66.24
Parks and Recreation	10,770	771,261.70	71.61
Public Works	58,750	4,722,278.76	80.38
Total for Base Accounts	240,068	32,228,853.85	134.25
New Accounts (actual)			
Total for New Accounts	0	0.00	0.00
Average EUI (actual)	240,068	32,228,854	134.25

Apendix

City of Maplewood Buildings and Grounds Detail

GHG Emissions			
Electricity Emissions (actual)			
Factor (Metric Tonnes per KWH)*	0.000705791		
Base Accounts (Metric Tonnes)	2,431.69	100.00%	
New Accounts (Metric Tonnes)	0.00	0.00%	
Subtotal Electric GHG Emissions	2,431.69	Metric Tonnes	
Natural Gas Emissions (actual)			
Factor (Metric Tonnes per Therm)	0.005302		
Base Accounts (Metric Tonnes)	1,071.61	100.00%	
New Accounts (Metric Tonnes)	0.00	0.00%	
Subtotal Gas GHG Emissions	1,071.61	Metric Tonnes	
Total GHG Emissions (actual)		3,503.30	Metric Tonnes
Total GHG Emissions (actual) per Facility Square Foot		32.17	pounds
Level of Confidence:		High¹	

Weather Normalized Totals***			
Normalization Factors			
HDD Normalizaiton Factor	112.68%		
CDD Normalization Factor	92.55%		
Normalized Energy Use			
Weather Normalized Total Electrical Use	3,381,166.80		
Weather Normalized Total Gas Use	222,616.93		
Normalized GHG Emissions			
Weather Normalized Electrical GHG	2,386.40	Metric Tonnes	
Weather Normalized Gas GHG	1,180.31	Metric Tonnes	
Total GHG Emissions (Normalized)		3,566.71	Metric Tonns
Level of Confidence:		High¹	

* Electricity factor based on grid specific data provided by EPA <https://www.epa.gov/energy/power-profiler>
** Natural Gas factor based on EPA data <https://www.epa.gov/energy/ghg-equivalencies-calculator-calculations-and-references>

*** Weather Normalized totals adjust energy use and GHG levels based on adjustments of Year against the region's 30 year average as determined through Heating (HDD) and Cooling Degree Days (CDD) for year as reported by NOAA <http://www.ncdc.noaa.gov/climate-information>. Factor is applied to 80% natural gas consumption and to 25% electricity consumption (typical heating and air conditioning shares)
1 High confidence level based on high quality energy metering and tracking at all facilities, emission factor rates from utility companies, EPA and DOE coincide, and normalization HDD and CDD calculations based on NOAA records.



Maplewood GHG Baseline Inventory



City Operations Carbon Baseline Streetlights and Signals

	2015 Baseline	% Total
Electricity Use		
Base Accounts (actual)	KWH	
All Base Accounts	571,872	100.00%
New Accounts (actual)		
Subtotal New Accounts	0.00	0.00%
Total Electrical Use (actual)	571,872.00	100.00%
GHG Emissions		
Electricity Emissions (actual)		
Factor (Metric Tonnes per KWH)*	0.000705791	
Base Accounts (Metric Tonnes)	403.62	100.00%
New Accounts (Metric Tonnes)	0.00	0.00%
Total GHG Emissions		403.62 Metric Tonns
Level of Confidence:		Good¹

* Electricity factor based on grid specific data provided by EPA
<https://www.epa.gov/energy/power-profiler>

1 Good confidence level based on high quality energy metering report for one month period. Full annual use projected. Improved confidence can be attained through full annual energy use data tracking. Emission factor rates from utility companies, EPA and DOE coincide.

Apendix

City of Maplewood Streetlights and Signals Detail
City of Maplewood City Vehicles Detail

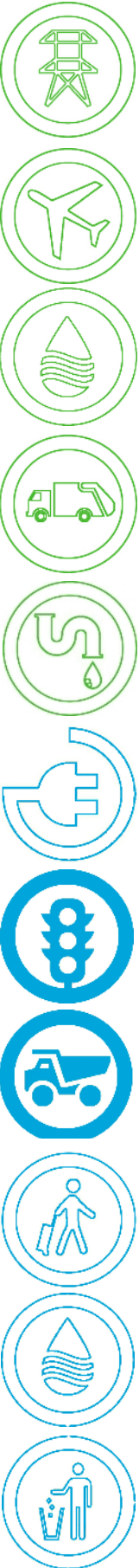


City Operations Carbon Baseline City Vehicles

Department	2015 Baseline	% Total
Gasoline Use		
	Gallons	
Public Works	137.00	0.30%
Fire Department	1,831.00	4.06%
Police	43,096.00	95.63%
Subtotal Gasoline	45,064.00	100.00%
Diesel Use		
	Gallons	
Public Works	33,743.00	68.76%
Fire Department	15,328.00	31.24%
Police	0.00	0.00%
Subtotal Diesel	49,071.00	100.00%
Total Fuel Used	94,135.00	Gallons
GHG Emissions		
Gasoline Emissions		
Factor (Metric Tonnes per Gallon)*	0.008908565	metric tonnes
Subtotal Electric GHG Emissions	401.46	Metric Tonnes
Diesel Emissions		
Factor (Metric Tonnes per Gallon)*	0.010151409	metric tonnes
Subtotal Electric GHG Emissions	498.14	Metric Tonnes
Total GHG Emissions		899.60 Metric Tonns
Level of Confidence:		High¹

* Gasoline and Diesel emission factors based on EPA data:
<http://www.eia.gov/oiaf/1605/coefficients.html#tbl2>

1 High confidence level based on high quality fuel use tracking, well established emission factor rates from US EPA.



Maplewood GHG Baseline Inventory



City Operations Carbon Baseline
City Employee Transportation

Department	2015 Baseline	% Total	
Commute	Employee Count	Total Miles	
Total City Employee Count	165		
Average Commute Distance (estimated round trip)*	24.36	Miles	
Total City Employee Commute Travel Annual**		1,004,850	Passenger Miles Traveled (PMT)
Single Occupant Commute Annual Share**	97.28%	977,518	PMT
Carpool Commute Annual Share **	1.00%	10,049	PMT
Public Transit Commute Annual Share **	0.00%	0	PMT
Walking/Biking Commute Annual Share**	1.72%	17,283	PMT
Commute GHG Emissions	Factor***	Subtotal	
Single Occupant Commute Emission per PMT	0.000387	379	metric tonnes
Carpool Occupant Commute Emission per PMT	0.000194	2	metric tonnes
Public Transit Commute Emission per PMT	0.000107	0	metric tonnes
Walking/Biking Commute Emission per PMT	0.000000	0	metric tonnes
Total Commute GHG Emissions		381	
Business Travel			
City Business Travel - Car		45,822	Miles
City Business Travel - Air***		43,915	Miles
Business Travel GHG Emissions	Factor***	Subtotal	
Car Travel Emission per PMT	0.000387	17.75	metric tonnes
Air Travel Emission per PMT	0.000274	12.03	metric tonnes
Total Business Travel GHG Emissions		30	

Total GHG Emissions	410.34 Metric Tonns
Level of Confidence:	Moderate ¹

* Round trip commute distance is based on US Census Buerae Maplewood average commute time and peak commuter speed data by Inrix <http://inrix.com/worst-corridors/>

**Commuter statistics based on 2015 City of Maplewood employee commute survey with 38% of staff responding. Survey indicated 98.28% of respondants driving, with 5.17% indicating carpooling "on occasion". For purposes of calculations, we have reduced sole-occupant car by 1% to account for occasional car pooling response.

*** Emission factors based on: Single occupant and Carpool - US EPA; Public Transit and Air travel based on EPA <http://nepis.epa.gov/Exe/ZyPDF.cgi/P1001177.PDF?Dockey=P1001177.PDF>

1 Moderate confidence level based on lack of detailed auto and air travel mileage tracking requiring estimation based on high quality financial records to establish miles traveled. Emission rates are high level of confidence.

Apendix

City of Maplewood Employee Transportation Detail City of Maplewood Water and Wastewater Detail



City Operations Carbon Baseline
Water and Wastewater Utilities

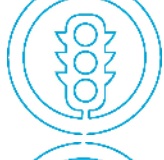
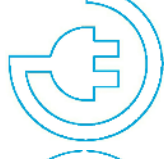
	2015 Baseline	% Total	
City Operated Facilities			
Electrical Use			
Base Accounts (actual)	KWH		
Treatment Facility	N/A		
Lift Stations (11 accounts)	61,962	100.00%	
New Accounts (actual)			
Subtotal New Accounts	0.00	0.00%	
Total Electrical Use (actual)	61,962.00	100.00%	
Natural Gas Use			
Base Accounts (actual)	Therms		
Treatment Facility	N/A		
Lift Stations (11 accounts)	0	0.00%	
New Accounts (actual)			
Subtotal New Accounts	0.00	0.00%	
Total Natural Gas Use (actual)	0.00	0.00%	
GHG Emissions			
Electricity Emissions (actual)			
Factor (Metric Tonnes per KWH)*	0.000705791		
Base Accounts (Metric Tonnes)	43.73	100.00%	
New Accounts (Metric Tonnes)	0.00	#DIV/0!	
Subtotal Electric GHG Emissions	43.73	Metric Tonnes	
Natural Gas Emissions (actual)			
Factor (Metric Tonnes per Therm)	0.005302		
Base Accounts (Metric Tonnes)	0.00	#DIV/0!	
New Accounts (Metric Tonnes)	0.00	#DIV/0!	
Subtotal Gas GHG Emissions	0.00	Metric Tonnes	

Total GHG Emissions**	43.73 Metric Tonns
Level of Confidence:	High ¹

* Electricity factor based on grid specific data provided by EPA <https://www.epa.gov/energy/power-profiler>

** Emissions do not include water/sanitary utility use at city owned facilities provided by non-city owned/operated utilities.

1 High confidence level based on quality energy use metering provided by City and well established emission factor rates from US EPA.





City Operations Carbon Baseline
Solid Waste

Annual City Facility Recycling Quantities (actual)*	2015 Baseline		
	Building Area (sF)	Total Recyc (lbs)	lbs/sf/yr
City Hall / Police Station	47,480	8760	0.18
Fire Station 2	10,403	3242	0.31
Fire Staiton 7	5,818	1148	0.20
McKnight Station	17,673	601	0.03
Community Center	86,144	4330	0.05
Nature Center	3,030	1,158.00	0.38
Parks and Recreation	10,770	8350	0.78
Public Works	58,750	8734	0.15
Total Recycling	240,068	36,323	0.15

Annual City Facility MSW Quantity (estimated)**	2015 Baseline		
	Building Area (sF)	Total MSW (tons)	lbs/sf/yr
City Hall / Police Station	47,480	8.59	0.36
Fire Station 2	10,403	3.18	0.61
Fire Staiton 7	5,818	1.13	0.39
McKnight Station	17,673	0.59	0.07
Community Center	86,144	4.25	0.10
Nature Center	3,030	1.14	0.75
Parks and Recreation	10,770	8.19	1.52
Public Works	58,750	8.56	0.29
Total Trash	240,068	35.61	0.30
Total Trash per FTE		432 lbs per year	

GHG Emissions	
Factor (Metric Tonnes per US Ton waste)***	0.19151 metric tonnes
Solid Waste GHG Annually	6.82 metric tonnes
Solid Waste GHG per FTE per Day	0.36 lbs/fte/work day

Total GHG Emissions	6.82 Metric Tonns
Level of Confidence:	Moderate ¹

* Based on data from Tennis 2015 annual recycling report
** Waste total calculated based on 51% recycling content total for community wide MSW handled according to data provided in Regional Indicators Initiative
*** Emission per Regional Indicators Initiative, blended rate of 0.368 metric tonnes GHG per US ton fossil waste Refuse Derived Fuel incineration and 0.448 metric tonnes GHG per US ton landfill waste

1 Moderate confidence level based on lack MSW quantity tracking (commonly not available). Estimations based on quality total community waste characteristics and quality waste sort efforts by City of Maplewood.



Report Prepared by



2515 White Bear Avenue, A8
Suite 177
Maplewood, MN 55109

612-669-7056

www.bluedotregister.org